Dr. Moor's technique is novel in this respect: it is a purely physical preparation of the specimen, thus providing a useful check on preparative methods which involve chemical fixation.

Figure 1 shows the vacuum and coating chamber of the Balzers 360M Freeze-etching Plant, supplied and installed at Bristol by agents for Balzers Aktiengesellschaft für Hochvakuumtechnik und dünne Schichten, FL-9496 Balzers, Principality of Liechtenstein.

A brief outline of the method is necessary for appreciation of the results which can be obtained. Living, unfixed biological material for freeze-etching is first cooled rapidly in liquid nitrogen before being placed on the cold specimen table (1). The metal hood of the vacuum chamber (15) is now lowered and clamped, and the chamber evacuated (5 - 12 minutes). The specimen is then struck repeatedly by a cooled razor edge (7) which is operated and advanced by external manual controls (5 and 8). Each stroke of the razor produces a new fracture-surface, which tends to follow the natural surfaces of the individual specimen. It is possible to study surfaces of membrane and other cell systems which are otherwise inaccessible. The fracture-surface becomes etched by a process of low-temperature sublimation in the vacuum chamber, and a replica of this etched surface is then produced by coating with, for instance, platinum.

After coating, the specimen can be raised to room temperature and pressure. The biological material is now dissolved away (using sodium hypochlorite solution followed by concentrated sulphuric acid) and discarded. It is the platinum replica which is carefully washed and floated on to a copper grid and in due course examined in the transmission electron microscope. Electron micrographs obtained in this way have a three-dimensional quality which is strikingly reminiscent of micrographs from a scanning electron microscope (Thompson & Hinton, 1968) (but of course far better resolution is possible using a transmission electron microscope). This three-dimensional appearance is not spurious, and genuinely allows a rapid, accurate appreciation of spatial relationships. The micrographs presented here (Figures *2* and *3*) illustrate this point rather clearly. They enable an immediate understanding of the shape of some of the components of the pulmonate sperm tail. It would be exceedingly laborious to build up such a clear picture of this kind of cell by reconstruction of serial sections through fixed material embedded in resin. It would certainly take many days, compared with 4 to 6 hours to obtain good micrographs of freeze-etched material.

Defects of the freeze-etching method are few. 1. The plant is expensive, costing about the same as a transmission electron microscope. 2. Certain organelles do not survive the preparation well. The β fibrils of flagella, for instance, become difficult to discern. 3. The Balzer 360M is a bulky apparatus, weighing approximately 500 kg. But the future is bright, with new models under development (some recently exhibited at the Micro 70 meeting held in Imperial College, London). Certainly, research workers planning projects in molluscan and other ultrastructure will want to examine the implications of freeze-etching in planning their work.

Literature Cited

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1968. Stereoscan electron microscope observations on opisthobranch radulae and shell-sculpture. Bijdr. Dierk. 38: 91 to 92; plts. 1 - 4

NOTES & NEWS

New Opisthobranch Records for the Eastern Pacific

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The three taxa discussed here are of interest because they represent new records for the eastern Pacific.

Plate Explanation

Transmission electron micrographs of freeze-etch-replicas of autosperms of pulmonate molluscs

Figure 2: Several sperm-tails from the vesicula seminalis of *Planorbarius corneus* (Basommatophora)

Figure 3: Part of the tail of a spermatozoon from the seminal vesicle of *Helix pomatia* (Stylommatophora)